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USSR Report

ELECTRONICS AND ELECTRICAL ENGINEERING

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USSR REPORT

ELECTRONICS AND ELECTRICAL ENGINEERING

No. 97

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CONTROL OF ROTOR SPEED IN DESIGN OF AUTOMATIC LAND GYROCOMPASS

LUKOVATYY, Yu. S., GLEYZER, V. I. and YABLONSKAYA, V. A., Leningrad Institute
of Precision Mechanics and Optics

[Abstract] The design of an automatic land gyrocompass in torsional suspension
is shown where, unlike in a conventional one, the angular momentum vector can
be made to change its orientation relative to the sensing element. This is
achieved by controlling the speed of the two gyromotors, both synchronous motors,
while the axes of their rotors remain at a fixed 90° angle to each other and
stationary relative to the sensing element. These gyromotors are rigidly
mounted inside the sensing element, a pendulum, and energized from two voltage
sources: reference and control. The electronic circuitry includes a photo-
electric angle transducer and an integrator. The system operates with a
computer. The performance of this gyrocompass is calculated from the system
of four equations of motion for the sensing element, in accordance with pre-
cession theory, its response speed is determined from the transient characteris-
tic, and its stability is established according to the Hurwitz criterion. On
this basis can then the design parameters be optimized with respect to maximum
response speed. The article was recommended by the Department (Kafedrz) of
Navigational Control Devices. Figures 3; tables 1; references 2: Russian.
[31-2415]

IMPROVING ACCURACY OF CALCULATING SIGNAL LEVELS ON TROPOSPHERIC RADIO LINES

KISELEV, O. N.

[Abstract] Conventional calculations of signal levels in tropospheric radio
wave propagation are based on ground-level values of the index of refraction
N_s, which may lead to considerable errors. In this paper a radiometeorological
parameter is suggested that characterizes the variability of the atmosphere
rather than its average meteorological conditions, i.e. the coefficient C_N
determined from the spatial structure function $D(\ell) = C_N t^m$, where ℓ is
separation and m is an exponent that depends on the type of transmission path,
usually taken as 2/3 on paths of direct visibility where only micropulsations
of the atmosphere are considered. For long-distance tropospheric propagation,
consideration must be taken of inhomogeneities of appreciable extent in the
horizontal direction, called meso-inhomogeneities, and in this case we should
take m= 1. Structure coefficients C_N were determined from calculated empirical
structure functions characterizing the maximum and minimum variability of the
field of the daily average index of refraction near the ground as well as the
structure function averaged over a year-long series of experiments with $\ell = 300$
km. Correlation coefficients were calculated between median values of the
attenuation factor F and the structure coefficient C_N for meso-inhomogeneities,
and also the corresponding correlation coefficients between N_s and F. The
results show closer relation between the new radiometeorological parameter and
radio signals than with the index of refraction. Figures 2; references:
5 Russian.
[18-6610]

NORM SETTING AND LENGTH OF MEASURING TIME FOR NOISE POWER IN TONE-FREQUENCY
CHANNELS OF REAL TROPOSPHERIC RADIO COMMUNICATION LINES

NEMIROVSKIY, A. S. and PAPERNOV, I. L.

[Abstract] Norms for noise power in tropospheric radio communication lines
are proposed which would meet IRCC recommendations in short and long line
segments, taking into account characteristics of fluctuations which occur 20%
of the time and those which occur 0.5% of the time. Specifically, noise in
tone channels is considered and its average-per-minute power is defined in
terms of its three additive components: thermal noise, multibeam crosstalk
and equipment crosstalk. A fundamental relation is established between the
resultant power of noise persisting at the receiver end longer than a certain
percentage of time and the length of a communication line consisting of any
number of segments with independently fluctuating noise, this relation being
approximately linear with empirically determined constants. On this basis is
then also established the necessary number and length of noise power measure-
ments to be made in order not to exceed prescribed error limits, assuming a
log normal distribution of noise probability at the output of the tone-frequency
channel of a real tropospheric radio communication line. Figures 3; references
5: Russian.
[298-2415]

PARAMETERS OF HORN ANTENNAS

YAMPOL'SKIY, V. G. and SUKHANOV, V. I.

[Abstract] In continuation of an earlier study of horn antennas, their design
and performance characteristics are analyzed on the basis of approximate
relations for an H-sectoral horn and an E-sectoral horn, the former fed with
an H_{01} wave through a rectangular waveguide and the latter fed either with an
H_{01} wave through a rectangular waveguide or with a TEM wave through a plane
waveguide. Essential in this analysis are the respective reflection coefficients,
particularly their dependence on the horn divergence angle and on the ratio of
waveguide wall width to wavelength of excitation mode. The s tudy also covers
a pyramidal horn with E-sector and H-sector fed through a rectangular waveguide.
Results of calculations are compared with experimental data. Figures 11;
references 8: 5 Russian, 3 Western (1 in translation).
[298-2415]

TRANSMITTANCE OF OPTICAL FIBER

GORDON, G. I. and TEUMIN, I. I.

[Abstract] The authors determine the complex transmittance of an optical
cable with respect to power modulation

$$\dot{K}(\Omega, \; l) = A(\Omega, \; l) \exp \left[i\phi(\Omega, \; l) \right],$$

where Ω is modulation frequency, l is the length of the fiber. This ex-
pression includes two characteristics: the amplitude modulation-frequency
response $A(\Omega, l)$ defined as the absolute value of complex transmittance with
respect to the power of optical radiation modulated by a harmonic signal as a
function of modulation frequency, and the phase modulation-frequency response
$\phi(\Omega, l)$, which is the phase of the complex transmittance of the envelope of
the power of the optical radiation modulated by the harmonic signal as a
function of the modulation frequency. Expressions are derived for these
characteristics for graded-index fibers with stepwise and parabolic behavior
of permittivity. It is shown that the phase modulation-frequency response
described by these expressions is a linearly increasing function with weak
oscillation, whereas the amplitude modulation-frequency response is a
decreasing and simultaneously oscillating function, and thus has the greatest
effect on signal distortion. This is because with increasing or there is
an increase in phase divergence of the propagating modes. This in combination
with the large number of modes gives rise to complicated interference processes
with gradual reduction of the resultant power of the optical radiation.
Figures 2; references 7: 3 Russian, 4 Western.
[18-6610]

INVESTIGATION OF OPTICOMECHANICAL CHARACTERISTICS OF OPTICAL FIBERS

SHITOV, V. V., GRIGORASH, V. V. and SHKALOV, A. A.

[Abstract] An analysis is done in order to determine optimum types of protective coverings that enhance resistance of optical fibers to mechanical stresses: tension, radial pressure, bending and twisting. Three types of coverings were studied: a tight coat, loose tube and combination of the two. Emission from an LG-52 laser was coupled into the fiber, and a local radial load was applied by an indentor rod with radius R against the fiber resting on a flat surface. Unprotected quartz fibers 150 micrometer in diameter were broken by loads in a range of 5.9-14.7 N. It was found that a tightly fitting coat of soft material (low-density polyethylene) does not reinforce the fiber in the radial direction. Tight coats of hard polymer materials (polyamide 610 and fluorocarbon polymer 2M) are also ineffective at small R (from 0.5 to 1 mm). The breaking radial load increases somewhat for larger R in the case of tight coats of hard materials, but is increased to 70-240 N for R = 1.3-2.8 mm with tight coats of moderately hard polymers (high-density polyethylene or polypropylene). With protection by loose tubes of hard and moderately hard polymers, the breaking load is 50-60 N at R = 0.5 mm and 70-100 N at R = 1.0 mm. Combined coverings are best for reinforcement against radial loading, the optimum combination being a tight coat of moderately hard polymer in a hard polymer tube. The type of protective covering should be selected to minimize attenuation with possible contact loads, which should not exceed 30 N for tubular covers of fluocarbon polymer or 60 N for tight coats of hard polymer or combined coverings. Figures 7; tables 2; references: 1 Western.
[18-6610]

STANDARDIZING OPTICAL CABLES

TEUMIN, I. I.

[Abstract] In an effort to standardize terminology relating to fiber-optics communications, the author examines some of the terms and definitions in the area of optical fibers and optical cable design. The work is based on the principle of reducing these terms and definitions to basic terms that can be combined to define any known designs. It is pointed out that caution is

necessary in drawing analogies between conventional cables and optical communications cables because the similarities may be only superficial. A table is given summarizing 18 suggested terms and definitions which are specific to fiber-optics communication. A standard abbreviation is given for each term. Justifications and explanations are given. Structural design features are proposed that can be used in developing a GOST standard for terms and definitions relating to optical cables. Tables 1; references: 2 Russian. [18-6610]

OBJECTIVE CRITERIA FOR PROFESSIONAL MICROPHONE QUALITY

BELKIN, B. G., GORELIK, V. M., USACHEV, V. V. and SHRAYBMAN, A. E., All-Union Scientific Research Institute of Cinema Photography

[Abstract] The authors describe an investigation of professional microphones of the standardized series KMS19 and microphones of the prominent foreign firms "Noyman" and "Zenichayza" (FRG) and AKG (Austria). Also investigated were two microphones produced by the People's Enterprise "Mikrofontekhnik Gefel" (GDR) which specializes in the output of standard capacitor microphones and microphones for professional sound recording. Microphones from this enterprise are successfully exploited in cinema, television and radio studios of the GDR and other CEMA countries. The equipment, conditions and methods of measurement are described in detail. Among the figures shown are block diagrams of units for measuring 1) The amplitude-frequency characteristics (AFC) with respect to a free field; 2) The characteristics of directivity; and 3) The AFC with respect to a diffusion field. Figures 6; tables 2. [20-6415]

ARS-1 EQUIPMENT FOR STEREOPHONIC RADIO BROADCASTING

KORGUZALOV, V. V. and SOLOV'YEV, V. Ye.

[Abstract] The ARS-1 equipment for steoroscopic radio broadcasting, developed to complement the "Dozhd'-2" mass-produced monophonic transmitter, is described. The technical characteristics of the ARS-1 bay with respect to the output of the complex stereo signal are presented as well as a block diagram of the bay. The operation of the components of the bay are considered. The technical characteristics and a description are given for the BVCh-1 high-frequency

block, the BDS-1 stereo decoding block and the BYI-1 visual indications block.
A prototype of the ARS-1 was successfully exploited in Bulgaria. A pressing
problem of the USSR Ministry of Production of Communication Means is to
expedite series output of the ARS-1. Figures 8; references: 1 Russian.
[6-6415]

ESTIMATE OF DEPTH RESOLUTION OF ULTRASONIC STEREOTELEVISION APPARATUS

MAMCHEV, G. V., Novosibirsk Institute of Electrical Engineering of Communica-
tions imeni N. D. Psurtsev

[Abstract] Ultrasonic flaw detection can be made more effective by use of
television equipment including a sound-sensitive picture tube. The general
principle of producing a visible image of the ultrasonic field and thus of
the internal structure of the inspection sample has already been proved
experimentally. The feasibility of three-dimensional inspection is considered
next. This involves producing two images of the object, a left-hand one and
a right-hand one, for stereoscopic viewing with both eyes through a spatial
selection system. The equipment consists of a chamber with liquid in which
the inspection sample is immersed, two quartz crystals in one wall for gener-
ating ultrasonic waves, an acoustic lens on the other side of the object,
and behind the latter a piezoquartz plate belonging to the sound-sensitive
picture tube in the opposite wall of the chamber. The object must be located
inside the chamber within the zone of stereoscopic viewing. The basic per-
formance criterion for this device is the depth resolution, which depends on
the geometry of the system including such important parameters as wavelength
of the probing ultrasound and aperture of the acoustic lens as well as refrac-
tive index at the object-liquid interfaces and resolving power of the picture
tube. The realistically attainable resolution, in terms of width of the
smallest detectable defect, depends also on diffraction effects within the
shadow zone. The article was recommended by the Department (Kafedra) of Tele-
vision. Figures 2; references 4: Russian.
[31-2415]

PARAMETERS OF SOME TYPES OF MATCHED OPTICO-MECHANICAL LINEAR LINE SCANNERS
FOR TELEVISION SETS

AVDEYEV, S. P., Leningrad Institute of Precision Mechanics and Optics

[Abstract] Optico-mechanical linear line scanners for use in television sets
are considered which match the carrier motion with respect to suppression and
yield a sweep with given characteristics. Most practical are rotary scanners,
a typical one designed for small scan angles with a sinusoidally oscillating
unilateral mirror. The main requirements are maximally uniform resolution
along a line and minimum image distortion due to "elongation" or scale error,
also avoidance of mechanical impact loads. Simple relations are given for
calculating the scanner parameters (scan angle, scan rate, oscillation frequency)
to match the sweep characteristics (line pulse duration, line-to-line angle),
in an approximation satisfactory for engineering purposes. The article was
recommended by the Department (Kafedra) of Optoelectronic Devices. Figures 3.
[31-2415]

EQUIPMENT FOR ORGANIZATION OF TV CHANNEL IN K-3600 SYSTEM

ASTASHKEVICH, A. S., KNEL', G. S., OKSMAN, A. K., and PEKEDOV, V. S.

[Abstract] A television channel with audio accompaniment and two broadcasting
channels is described. The unit was organized in the K-3600 system of trans-
mission instead of the lower 1800 channels of audio frequency. The TV channel
uses the frequency band of 6600 kHz with a carrier frequency of 2491.1 kHz.
The frequency bands 841-858, 919-936 and 997-1014 kHz are used for the three
audio channels. The equipment uses transistors and microcircuits. The para-
meters of the output stage are discussed as well as the principal special
features. Four photographs of the exterior of the unit are presented.
Figures 3; references: 5 Russian.
[6-6415]

YAKHONT-A MONITORING EQUIPMENT FOR TELEVISION TRANSMITTERS

ZOLOTOV, B. I., SHTOKOLOV, G. V. and SHCHURSKIY, V. I.

[Abstract] The "Yakhont-A" monitoring equipment is designed for operation in the formation of stationary automated television radio stations. It consists of equipment for local monitoring and measuring, and equipment for distant monitoring. Both of them are described and photographs of their exteriors are presented. A simplified block diagram of the monitoring equipment is explained. Basic data for separate devices is presented. A considerable part of the devices of the complex of equipment described in the paper are produced in series and are also used for monitoring and measurements in other units for the transmission of a TV signal. Specifications and a description are given for the following: 1) Analyzer of differential-phase distortion; 2) 20T pulse analyzer; 3) Demodulator; and 4) Side band analyzer. The equipment for monitoring discussed above is included in the composition of new USSR television radio stations. Figures 5; tables 1; references: 4 Russian. [6-6415]

POTENTIAL SENSITIVITY OF TV CAMERAS BASED ON CHARGE-COUPLED DEVICES

SMIRNOV, V. D., All-Union Scientific Research Institute of Television

[Abstract] The author notes that USSR and foreign literature is repeatedly concerned with the outlook for new multielement radiation detectors--solid state analogs of TV transmitting tubes on the basis of charge-coupled devices. The present paper determines the potential sensitivity (confined to generation-recombination current noise of the phonon flow) of these devices operating on a bright uniform background close to the photon fluctuation noises of background radiation. It is stressed that the results obtained apply to an ideal charge-coupled device-photodetector, the sensitivity of which is only determined by the phonon fluctuations of the radiation background. In a few words, however, these results can also be transferred to the case of real photodetectors. References 14: 12 Russian, 2 Western. [20-6415]

CORRELATION OF COLOR TRANSMISSION OF REPORTING CAMERA BY CHANGE OF COLOR DIFFERENCE SIGNALS

VERBITSKAYA, I. B., VNIITR (All-Union Scientific Research Institute of Television and Radio Broadcasting)

[Abstract] An investigation is made of the potentialities for regulation of color transmission without impairment of the balance with respect to white. This possibility provides a change of the color difference. The color transmission of a KT312 camera was considered. The camera operated without a matrix with the magnitude of the rough index of nonlinearity $\gamma = 1.26$ ($\gamma_1 = 0.45$, $\gamma_2 = 2.8$). A fundamental diagram of the signal conversion in the camera is presented. A method is presented for color transmission correction which has 10 alternatives for changing the color difference signals. Change of the color difference signals with respect to numbers 5,6 and 9,10 of the 10 alternatives gave identical change of the colors but with numbers 5,6 the range of regulation is broader. It is concluded that in order to change color transmission with the object of agreement with the color transmission of other cameras and for the improvement of the transmission of flesh tones, it is advisable to use the method for regulation of the color difference. The advantage of this method is the consideration of balance with respect to white. Calculations in the work were conducted on a series YeS computer on the basis of complex modelling programs developed at VNIITR. Figures 2; tables 6; references 5: 3 Russian, 2 Western.
[20-6415]

OPTICAL CHANNEL OF VIDEO RECORDER

VASILISHIN, V. L., DOVGAN', A. P., DROBOT, M. I., SEN'KO, I. M. and EKTOV, A. I.

[Abstract] The principles of operation and the special features of the optical channel of a disc video recorder are described in detail. The circuit of the optical channel is presented. It consists of the following: 1) Laser; 2) Matching lens system; 3) Mirror of the scanner; 4) Beam splitter block; 5) Plate $\lambda/4$; 6) Rotating mirror; 7) Micro-object; 8) Video disk; 9) Astigmatic lens system; and 10) 4-element photodetector. The arrangement is also shown of the astigmatic lens system with a 4-element photodetective. Figures 3; references 8: 1 Russian, 7 Western.
[20-6415]

ALGORITHM AND DEVICE FOR IDENTIFICATION OF INSTANT WHEN CONTROL ACTION
BEGINS

DOBZHELEVSKIY, N. Ya. and KOPYLOV, A. M., Military Engineering Institute imeni
A. F. Mozhayskiy

[Abstract] An m-algorithm of identification is proposed for determining the
instant in real time when control action begins. This algorithm is applicable
to a priori unknown control action, with measurements made at uniformly spaced
discrete time intervals. The measurement vector is equal to the sum of the
measurement function and the error vector, the measurement data being processed
in real time according to a Kalman-type algorithm of dynamic filtration. The
identification algorithm follows first the overestimation criterion and then
the monotonicity criterion for each element of the state increments vector.
The most difficult step is calculating the number of measuring time intervals
elapsed since control action has begun, but this is done by simple arithmetical
operations. The article was recommended by the Military Engineering Institute.
References 3: 2 Russian, 1 Western (in translation).
[31-2415]

ITTCC RECOMMENDATIONS ON JOINING CONDUCTORS OF COMMUNICATION CABLES

NIKOL'SKIY, K. K.

[Abstract] A set of recommendations on joining conductors of communication
cables has been developed by the Sixth ITTCC Research Group and subsequently
amended at the seventh (1980) plenary session in Geneva. They cover symmetric
as well as coaxial cables with copper or aluminum conductors, taking into
account conductor structure and material, insulation structure and material,
required electrical and mechanical characteristics, for of connection and
technology. The four principal methods of joining symmetric pairs are by
twisting, soldering, welding, or special-purpose connector. One recommended
technology of conductor joining involves use of thermosetting tubes with pre-
inserted solder rings. Special-purpose connectors, particularly suitable for
assembly of multipair cables, are generally adaptable to semiautomatic joining.
Such connectors come in three basic forms: with serration, with metal catch
(U-connectors, "Utilux", "Bi-Wire"), with slit or pin and sleeve ("PAZ" for
copper conductors, "PAZA" for aluminum conductors). Inner conductors of co-
axial cables are joined by soldering, crimping, or threaded connector. Outer
conductors of coaxial cables are joined by soldering with use of cylindrical
sleeves and thermosetting tubes or by crimping and mechanical fastening,

avoidance of gaps being very important here. Cable splices are shielded and insulated, with metal tubing and plastic or paper tape respectively. The recommendations cover also quality inspection during the manufacturing process, by performance tests and aging tests. Figures 6; references 2: 1 Russian, 1 International.
[298-2415]

CIRCUITS AND SYSTEMS

OPTIMAL FILTRATION OF OUTPUT SIGNALS FROM STORAGE-TYPE ANGULAR-DISPLACEMENT
AND LINEAR-DISPLACEMENT TRANSDUCERS

ZHABREYEV, V. S. and VOINOV, I. V., Chelyabinsk Polytechnic Institute imeni
Lenin Komsomol

[Abstract] Storage-type converters of nonelectrical quantities such as
angular or linear displacements to electric signals feature high accuracy and
high resolution. Their main drawback is ambiguity of readings, which requires
optimal filtration of the output signals. The information carrying signal is
usually amplitude or pulse-amplitude modulated, one which can often by
approximated with a simple trigonometric (cosine) relation. The performance
of an optimum receiver for a displacement transducer is calculated according
to nonlinear filtration theory, the corresponding mathematical model consisting
of two ordinary differential equations for the optimum estimate (corresponding
to maximum a posteriori probability) and the a posteriori dispersion
(characterizing the error at any instant of time), with both drift and diffusion
taken into account. Synthesis of the optimum receiver is based on the re-
solvent differential equation, its structure being more intricate than that
of the classical version but requiring only one information transmitting
channel, rather than two (sine - cosine) or more, for interpolation of trans-
ducer output signals. The article was recommended by the Department (Kafedra)
of Automatic Control Systems. Figures 1; references: 4 Russian.
[31-2415]

EFFECT OF RANDOM COMPLEX SIGNALS DELAY ON CHARACTERISTICS OF DISCRETE
(DIGITAL) FILTERS

GARIBYAN, M. L.

[Abstract] Discrete matched filters are promising devices for complex phase-
shift keying of signals, making it possible with the aid of digital and analog

methods of processing to develop a filtration algorithm, technically more simply realized than for analog and "linear" digital filters. An investigation is made of the properties of discrete matched filters with binary quantization. A further investigation is made of the effect of random delay of signals on the noise immunity of discrete matched filters, with the special features of multilevel quantization and the presence of automatic gain control in the receiving taken into account. An analysis made with respect to the effect of fluctuating interference. The energy losses in the filters investigated are compared with the losses with analog types. Figures 3; references: 6 Russian.
[5-6415]

OPTIMIZATION OF OUTPUT FILTERS FOR LOW-FREQUENCY CHANNEL OF KAN AMPLIFIER

LAVRUSHENKOV, V. G. and KHARITONOV, A. V.

[Abstract] Polynominal filters are considered for application as output filters in the low-frequency channel of Kan power amplifiers with transistor elements and with separate amplification of single-band-modulated signal components. The optimum amplitude-frequency characteristic is determined on the basis of the transfer function, as a tradeoff between a uniform one required for avoiding frequency distortions and a nonuniform but maximally smooth one for suppression of products of pulse width modulation. Calculations yield relations describing the dependence of the maximum transfer ratio and the upper cutoff frequency on the coefficients in the transfer-function polynominal. Results are shown for two-, three-, and four-section LC filters. Figures 2; tables 1; references: 6 Russian.
[298-2415]

OPTIMAL DISCRETE FILTRATION OF SIGNALS WITH ADDITIVE AND MULTIPLICATIVE BACKGROUND INTERFERENCE

VASIL'YEV, K. K. and MISHIN, N. M., Ul'yanovo Polytechnic Institute

[Abstract] Feasibility of linear filters for optimal processing of signals with both additive and multiplicative background interference is considered

on the basis of two models of interacting nonstationary random Markov
sequences. The first model is one of discrete-in-time observations and
corresponds to n-channel transmission of a scalar signal over a communication
line with mutually noncorrelated zero-mean additive noise and zero-mean
multiplicative interference. The second model corresponds to transmission
of an n-component vector signal over a multichannel line describable by a
deterministic nXn matrix with multiplicative interference common to all
channels. Noise and interference are each described by a corresponding auto-
regression equation. Through derivation of the Kalman equations with applica-
tion of the orthogonal-projection lemma, multiplicative interference is found
to be replaceable by an equivalent additive one. The article was recommended
by the Department (Kafedra) of Theoretical Principles of Radio Engineering.
Figures 2; references 5: 3 Russian, 2 Western.
[31-2415]

MATCHED FILTRATION OF COMPLEX SIGNALS BY MULTICHANNEL NONSWITCHED FILTER

PER'KOV, V. V.

[Abstract] A new version of the construction of a broadband communication
system with matched filtration of the signals received by a multi-channel
nonswitched filter is proposed and the basic concepts of it are explained.
The noise immunity of the proposed system is thoroughly analyzed. The analysis,
which takes into account the substantially realized advantage bears witness
to the promising future for use of the proposed method of construction of a
broadband communication system. Figures 2; references: 4 Russian.
[5-6415]

STRUCTURE OF SECOND-ORDER DIGITAL FILTER WITH SMALL ROUNDOFF ERROR

ANISIMOV, S. N., Rostov-na-Donu

[Abstract] A second-order digital filter containing delay elements with
transfer functions $W(z) = (1 - z^{-1})^{-1}$ is modified for reduction of the roundoff
error. The new version features a symmetric structure with a compensating
multiplier in the error transfer function corresponding to each error source.

It contains, in addition to seven multipliers, three adders and two delay modules with feedback loops per stroke. The filter is designed on the basis of the canonical second-order transfer function and relations between coefficients of this function and the seven multiplier coefficients (including two feedback coefficients, one for each loop) which must be satisfied. Results of simulation on a YeS-1022 Unified System digital computer with typical values of coefficients indicate that the roundoff can be thus reduced to one half and its dispersion to one quarter. Figures 2; tables 1; references 3: 1 Russian, 2 Western.
[31-2415]

ELECTRICAL CIRCUIT, A MODELLING DEVICE WITH CHARGE COUPLING

PROZOROVSKIY, V. Ye.

[Abstract] Charge coupling devices (CCD) do not enter into the basic set of circuit elements for known programs of machine analysis of electronic circuits. Consequently, development of electrical circuits which model CCD, and determination of the parameters of their elements are of pressing interest. In the present paper a modelling device is proposed which models the charge under the transfer electrodes and under the gap between them. The proposed modelling device profitably differs from such known devices by the fact that the parameters of the steady-state regime (existing in the form of the regime of a modelling circuit) are obtained alike, independent of the number of units which are utilized. This expands the possibility of using one-unit models and models which are variable in the process of calculation by the number of units, which makes it possible to shorten the time for machine analysis of the process in a device with charge coupling. Figures 5; refferences 8: 5 Russian, 3 Western.
[5-6415]

STR-P RACK FOR DISTRIBUTION FEEDERS

UMNOV, L. P., chief of Central Industrial Laboratory of PEPR (expansion unknown), MGRS (Moscow City Broadcasting Radio Diffusion Network)

[Abstract] A description is given of the STR-P rack for distribution feeders which was developed at the Industrial-Experimental Enterprise of MGRS. The STR-P rack, an exterior photograph and a block diagram of which are presented, is installed at transformer substations of a broadcasting radio diffusion

network. Provision is made in the system for local acoustical control of
the signals of the three broadcasting programs at the start of any of 12
connected distribution feeder lines (DFL) as well as measurement of the
modulus of the input resistance and the insulation resistors. The rack con-
tains indicators of the level of the input signals of the three programs.
Detailed technical data are given with respect to the rack. Figures 2.
[21-6415]

COMMUNICATIONS

INNOVATIONS SPEED RADIO RELAY LINE CONSTRUCTION

Moscow VESTNIK SVYAZI in Russian No 7, Jul 82 pp 26-28

[Article by V. G. Yartsev, deputy chief, "Radiostroy" trust: "Rapid High-Quality Construction"]

[Text] In 1981, "Radiostroy" trust completed construction of one of the largest main radio relay lines for organizing intercity communication channels. The planned production facilities were introduced ahead of schedule in 21 months (instead of the 39.5 months called for by norms for duration of construction), and with good quality. The construction period was shortened by using industrial methods of construction and a number of engineering and organizational steps.

Before starting construction, the USSR Ministry of Communications had oriented the collective of the trust toward further development of industrialization and improvement of construction efficiency. Deadlines were specified for planning, beginning of construction, introduction of the first starting complex, material and technical supply, and steps were outlined for industrializing methods of radio relay line construction.

A peculiarity of this radio relay line is that it passes over mountainous (up to 3000 m) inaccessible country without railroads. In this connection, specialists of GSPI-2 [The Second State All-Union Design and Planning Institute of the USSR Ministry of Communications] and "Radiostroy" trust developed a plan for organizing construction that provided for: construction of a reception freightyard, tractor roads and power transmission lines; organization of a special mechanization section; transportation of about 10,000 metric tons of various kinds of freight from the reception yard to the stations to be constructed; a considerable volume of drilling and blasting.

To accelerate construction of the radio relay lines, various organizations were enlisted in the work: not only the USSR Ministry of Communications, but also the USSR Ministry of Power and the USSR Ministry of Installation and Special Construction Work.

Delivery of structural iron and prefabricated concrete, cable goods and other necessary materials was organized by schedules. The extensive mechanization section brought together 45 transport vehicles, 32 pieces of heavy machinery including 11 bulldozers and 7 self-propelled cranes. Considerable attention
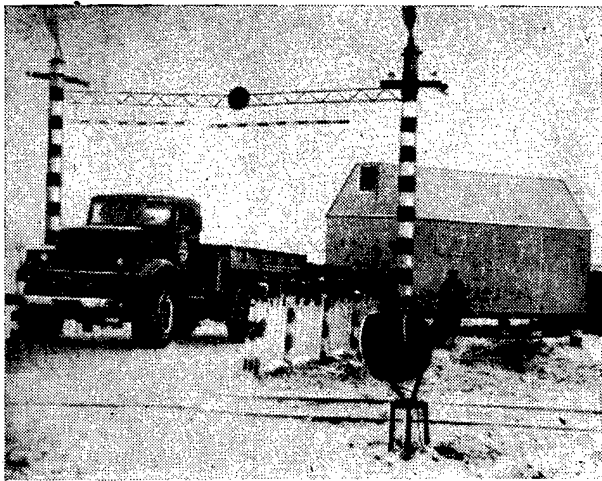
Transporting prefabs to freightyard
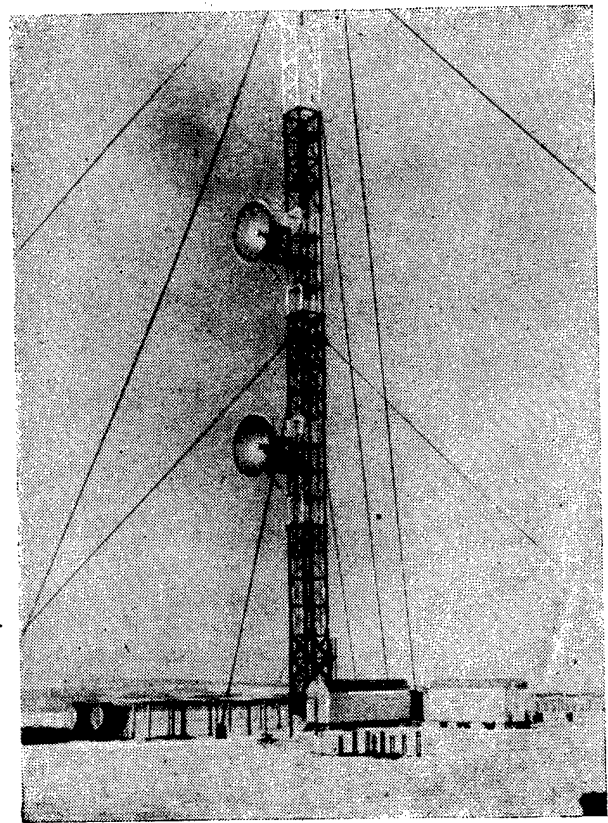
Mountain radio relay line
station
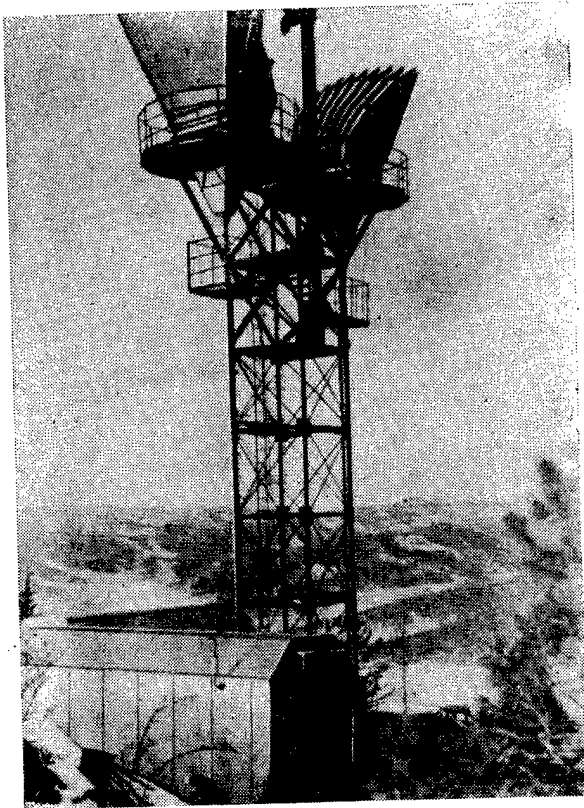
Overall view of intermediate
radio relay line station set up by
using prefabricated diesel base and
equipment shed
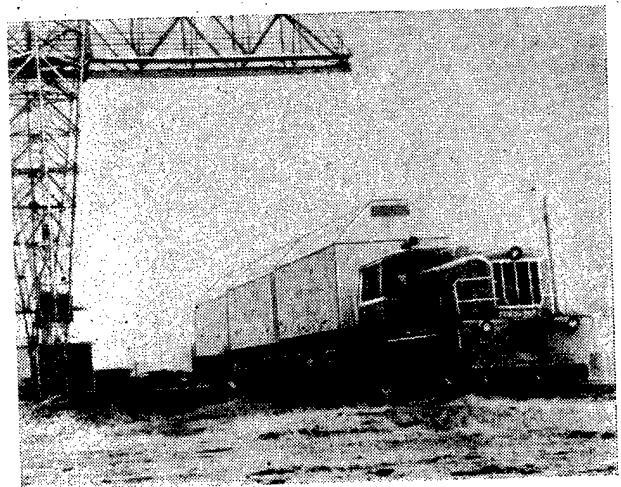
Shipping prefabs from plant

was given to organizing living conveniences for the construction workers. Thirty house trailers for millwright teams were consigned to the radio relay line as well as 20 mobile electric power generating plants.

Assimilation of capital investments was considerably aided by detailed analysis of all plan decisions and timely updating of the plan. Refinements were made in the location of some stations, routing of power transmission lines and tractor approach roads. The aluminum service buildings for intermediate stations were replaced with prefabs developed by GSPI-2 in conjunction with "Radiostroy" trust. The use of prefabricated new buildings under such difficult construction conditions gave considerable advantages.

The prefab measures 8400 x 3382 x 3160 mm. The frame is made of ordinary carbon steel, insulating panels are made of FRP-1 foam plastic, and the floor -- from FBS bakelized plywood 18 mm thick, or composition board 20 mm thick with linoleum covering. Wall facing is decorative plastic-paper laminate or thin sheet steel covered with Lincrust. The prefab has two doors in the endwalls sealed around the perimeter with a rubber gasket. The outer covering of the prefab is thin sheet steel welded with a completely watertight seam, painted with weatherproof enamel. The prefabricated equipment room accommodates the "KURS-4" equipment with electric power supply and life-support systems, storage batteries; the prefabricated diesel base accommodates two DGA-16 diesels with panels and RTsTA equipment.

Perhaps the most telling factor for shortening time of construction of the radio relay line was installation of the equipment in the prefabs under factory conditions, and transportation by a method specially developed for mountain conditions. Without interrupting work at intermediate stations on laying foundations for the antenna towers and setting the iron for the towers themselves, work was in progress at the same time under factory conditions with installation of heating, lighting and ventilation systems in the prefabs, putting in cables and technological equipment, adjustment of diesels. For one station, the radio equipment was included in a prefab. An experimental model of an intermediate station in prefabs has been accepted by the GUMTS Commission [expansion not given] of the USSR Ministry of Communications for the OMMZ [expansion not given] of "Radiostroy" trust and recommended for installation on radio relay lines.

It was just as important to decide how to transport the prefabs to the installation point under mountain conditions at altitudes up to 2000 m. It was impossible to transport buildings of such size and weight by helicopter, and the use of trailers was also ruled out. A way out was found by specialists of Mechanization Management. They proposed the use of special mechanized sledges. Powerful articulated trucks were put together with the use of transport facilities of local organizations for hauling large consignments of freight (prefabricated concrete, structural iron for antenna towers, antennas, electronic equipment, wooden poles for power lines).

Special mention should be made of the organization of transportation of prefabricated equipment sheds and diesel bases with installed equipment. The prefabs were delivered from Moscow by railroad to the freightyard. They were

then hauled by trailer over the main route through two mountain passes. The
prefabs were delivered to the installation site on special metal sledges by
three bulldozers: two bulldozers in a hitch pulled the sledge with the prefabs
and the third bulldozer pushed the sledge over difficult rises and where turns
were needed. For this purpose a special column was organized made up of two
KRAZ-255V tractors, two 4MZAP-5523 trailers, a refueling truck based on a
ZIL-131, a mobile repair shop based on a ZIL-131, two SK-3562 self-propelled
cranes, three DZ-27 bulldozers and two UAZ-469 and GAZ-66 trucks.

One can only admire the courage of the drivers and mechanics who managed to
transport buildings 8.5 m long weighing 10 metric tons across a mountain river.

While the prefabs were being made and equipment installed under factory con-
ditions, stand tests were being done on the "KURS-4" electronic equipment
for two work places with a complete set of measurement equipment. Specialists
of TTsUMS-8 [expansion not given], the manufacturing plant, the Scientific
Research Institute of Radio and "Radiostroy" trust were able to discover and
eliminate a number of malfunctions of the "KURS-4" equipment in these tests.
As a result, there were no serious failures of the radio equipment when the
line was put into operation.

The YuAPP-4 device developed by SSKTB [expansion not given] and made by the
Scientific Research Institute of Radio enabled alignment of the antennas before
installing the electronic equipment in the waveguide channels.

A number of serious flaws were also discovered during construction of the
radio relay line. Most important was poor finalization. There was an inad-
missible delay of nearly a year in finalizing the auxiliary equipment of the
prefabricated equipment sheds and diesel bases. There was a considerable
delay in arrival of the prefabs at the freightyard.

It was impossible to install the "KURS-4" radio equipment and to assemble
the storage batteries simultaneously in the equipment shed since the SZ-5
batteries are made in glass containers and can be assembled only at the site
of permanent installation. Therefore it was necessary to deliver the components
for making up the storage batteries and the units for charging them with in-
stallation in sequence on the radio relay line under severe winter conditions.

What are the conclusions that can be drawn from experience in construction
of this radio relay line? What was it that helped the workers of the trust
to achieve success despite difficulties? Primarily it was a high-quality
plan. All radio relay stations were designed with a minimum set of equipment
adequate for operation. Living quarters, buildings of the emergency repair
service and boiler room, and costly engineering facilities were installed
on an outlying site near populated zreas. This enabled comparatively rapid
construction and activation of junction centers and intermediate stations,
and simultaneous construction of buildings and structures requiring immea-
surably longer time for erection.

More careful consideration should be given to questions of electric power
supply. According to existing rules, three sources are required for electric

supply to radio relay stations: outside line (from one source), two diesel generators and a storage battery. However, design institutes incorporate one more outside power source (a fourth), which may be advisable for power lines no longer than 1.5-2.0 km. To resolve this question, the design institute should consider local conditions in conjunction with the builders. Provisions should be made for constructing one power line in the starting complexes of facilities. A second (longer) power line should be built before completion of radio relay line construction.

Institutes include in the plan more than 100 types of power line supports depending on wind and ice loads and so forth. With this many types of supports, it is a complicated matter to industrialize power line construction. It would be a good idea for GSPI and "Sel'energoproyekt" Institute to reduce the number of support types in plans.

As our experience has shown, rapid and high-quality construction necessitates the use of prefabricated buildings with installation of electronic equipment at the plant. An advisable variant for imported equipment is installation of bay frames with high-frequency plugs in the prefabs. Then at the installation site it only remains to "initialize" the frames with the necessary modules.

For further industrialization of radio relay line construction it is necessary to have a unified engineering decision on design of insulation, heating and placement of technological equipment, and to have a standard plan for installation of the different types of equipment in the prefab. It is only in this way that the cost of the prefabs and of their series manufacture can be reduced. With the conversion of electronic power supply from alternating to direct current, new problems have arisen. Specialists of "Radiostroy" trust, GSPI, the Scientific Research Institute of Radio and TTsUMS still have a lot of work to do to solve these problems.

6610
CSO: 1860/22

PROMISING TRANSMISSION SYSTEMS

[Article by I. P. Maslenkova]

[Text] The Scientific-Technical Council of the USSR Ministry of Communications
has heard and discussed a report by TsNIIS [Central Scientific Research Insti-
tute of Communications], "Current State and Outlook for Development of New
Transmission Systems, Order of Updating Existing Equipment for Coaxial and
Symmetric Cables, Removal of Obsolescent Equipment From Production".

The report noted that as of now long-line and intrazonal exchanges are equipped
with analog transmission systems. In the 10th Five-Year Plan, the new K-3600
and K-1920P systems began to be introduced on the nation-wide hookup with
the new set of OKOP conversion and tandem equipment. The K-1020S systems
began to be used for reconstruction of symmetric long lines. The K-10800
system is being developed for the nation-wide hookup, and the K-420 system
is being developed for intrazonal and departmental exchanges, and plans are
being made to develop a promising family of analog transmission systems with
technological and component base in common with the K-10800 system.

At the same time, a set of digital transmission systems is being developed.
The IKM-30 system is being introduced on metropolitan telephone exchanges,
and the IKM-12M (IKM-15 since 1981) is being introduced in rural exchanges.
The IKM-120 and IKM-480 are being developed for intrazonal exchanges, and
the IKM-30S -- for rural exchanges. Introduction of these systems is starting
in the Eleventh Five-Year Plan.

At the present time the IKM-1920 is being developed for the nation-wide hookup.
Plans are being made to develop more powerful and efficient digital transmission
systems: IKM-480X2, IKM-1920X2 and so on. The IKM-30 and IKM-120 systems
are being updated. Work is in progress on plans for the first phase of a
primary long-line digital exchange.

During the 10th Five-Year Plan, the first research and development work was
done on fiber-optics digital transmission lines at speeds of 2 and 8 Mbit/s
for the IKM-30 and IKM-120 systems, including a check on experimental lines.
During the 11th Five-Year Plan, these fiber-optics lines are to be intro-
duced on metropolitan telephone exchange trunks with total extent of 500 km,

and also on the first lines in intrazonal exchanges. Plans are being made
to develop fiber-optics digital transmission systems for the IKM-480 and
IKM-1920 in intrazonal exchanges and on the nation-wide hookup.

The report stated that since most of the switching stations in the USSR during
the 11th and 12th Five-Year Plans will be of the analog type (electro-
mechanical and quasielectronic), while the proportion of channels organized
by digital methods will still be low, both analog and digital systems will
be used mainly for setting up analog channels and house exchanges. Digital
transmission systems should be used primarily on local and intrazonal exchanges,
concentrating them in individual regions, setting up continuous digital lines
with a minimum number of junctions with the analog transmission systems on
the primary network. Such a method of introducing digital transmission systems
combined with introduction of digital switching methods in automatic and
direct-dialing offices will ensure an additional gain through economizing
on analog-digital converters.

The K-1920P and K-3600 analog transmission systems that are being introduced
in exchanges correspond in electric parameters to the present-day level of
technology, the requirements of YeASS [Unified Nation-Wide Communications
System], and have been recommended as basic systems for constructing and updat-
ing long lines. However, the equipment in these systems is large and heavy,
requires cumbersome metal cans for unattended repeaters, and large enclosures
for terminal stations and unattended repeaters, and is not sufficiently eco-
nomic in use.

The new K-10800 system is being developed on up-to-date technological and
component bases that should also be used in later developments of analog trans-
mission systems. Calculations show that transmission systems can be developed
on the technological and component base of the K-10800 system that are more
effective than the K-3600 with identical length of a section and about 5400
channels.

To maximize efficiency in future in the reconstruction of long lines, it will
be necessary to retain the length gradation of 6.3 km and 1.5 km repeater
sections in prospective transmission systems.

For the most economic construction of the network, better organization of
series production, reduced cost of equipment and facilitating utilization,
it is also suggested that design be standardized on the major components of
the line channel of the transmission systems: containers of unattended re-
peaters and NRP [expansion not given], cable lead-in devices, and also remote
supply systems, link between operators and remote control.

The Scientific-Technical Council of the USSR Ministry of Communications has
approved the main directions of development and introduction of transmission
systems in accordance with the proposals outlined in the TsNIIS report. It
was noted in the Council's decree that the basis of development of the wire
communications network should be coaxial cables on which major transmission
systems (analog and digital) will be based. After completion of the develop-
ment of fiber-optics cables and the corresponding transmission systems, this

type of cable should be used as well. The decree of the Scientific-Technical Council notes that construction of long transmission lines with use of symmetric cable should be curtailed.

Digital transmission systems should be used in the main on intrazonal exchanges.

Symmetric cable lines should be modified to increase traffic handling mainly by using the IKM-120 and IKM-480S digital transmission systems, and also the K-1020S analog transmission system. In future, construction of new long lines with symmetric cables should also be curtailed on departmental exchanges.

The family of analog transmission systems (K-1920, system with about 5400 channels, K-10800) and also the family of digital transmission systems (IKM-1920, IKM-1920X2, and also more powerful digital transmission systems) are recommended for the nation-wide primary hookup as prospective transmission systems on coaxial cables with 2.6/9.4 pairs; the IKM-480X2 digital transmission system is recommended for transmission on coaxial cables with 1.2/4.4 pairs (mainly on nation-wide trunks).

Recommended as promising systems for the intrazonal primary exchange are: the K-420 analog transmission system on single-coaxial cable type 2.1/9.7 that will also solve the problem of development of departmental exchanges; IKM-480 and IKM-480X2 digital transmission systems on 1.2/4.4 coaxial cable, and also the IKM-120 and IKM-480S for modernization, and in some cases new construction of symmetric cable transmission lines.

In accordance with the decision of the Scientific-Technical Council it is advisable on local exchanges to use digital transmission systems IKM-15, IKM-30, IKM-120, and in isolated cases IKM-480.

At the same time, it remains to organize development and production of equipment for interaction between analog and digital transmission lines on the primary network: ATsO-ChD-60, 300, 900 codecs; 2X30/60 transmultiplexers; 1X64 and 2X64 modems (primary channel of analog transmission systems); 1X480 and 2X480 modems (secondary channel of analog transmission systems); 1X2048 and 2X2048 modems (tertiary channel of analog transmission systems).

The necessary volumes of production of prospective equipment of transmission systems for the nation-wide primary hookup should be determined by the State Institute for Research, Design and Planning of Communications Installations (Giprosvyaz') in 1982. Replacement of obsolescent transmission systems with prospective systems will be done gradually in conformity with the volume of production of new equipment.

6610
CSO: 1860/22

EFFICACIOUS STRUCTURE OF DEPARTMENTAL METROLOGICAL SERVICE COMPONENTS IN
COMMUNICATION SECTOR

GRANATUROV, V. M., MOROZ, N. P. and NEKRASOV, V. S.

[Abstract] Instrument test and repair laboratories are being built by
regional production-engineering communication management enterprises for the
purpose of providing the communication industry with effective metrological
service. The structure and organization of these laboratories must be
designed most efficaciously so as to minimize both installation and operation
costs while ensuring that all standard regulations and customer requirements
will be met. An important determining factor here is the optimum distribution
of work load between these regional laboratories and existing territorial
State supervision laboratories. A simple interate algorithm of design and
optimization according to these criteria has been programmed for computer
calculations on the basis of input data including instrument inventory and
replacement figures as well as equipment and testing cost figures. Typical
numerical results are shown, assuming use of reference measurement standards
only, based on studies made at the Odessa Institute of National Economy.
Figures 2; tables 2; references 5: 4 Russian, 1 Western (in translation).
[298-2415]

OPTIMIZATION OF STATISTICAL PARAMETERS OF MULTIPOSITION CODES FOR DIGITAL
TRANSMISSION SYSTEMS

LEV, A. Yu. and MARKARYAN, G. S.

[Abstract] The problem is solved of deriving optimum values of the matrix
of transition probability of multiposition alphabetic codes which assures

the maximum energy of a digital transmission system in a specified frequency band. In so doing a number of requirements are met such as absence of fixed components, presence of timing information and the low level of frequency components in the energy spectrum of the signal. References: 5 Russian.
[5-6415]

METHOD OF CALCULATING RADIO WAVE ATTENUATION IN RAINFALL ON GROUND-LEVEL TRANSMISSION PATHS

LARIN, Ye. A.

[Abstract] A method is developed for calculating attenuation of radio waves on frequencies above 10 GHz in rainfall on communication lines near the ground. The proposed technique is based on a limited number of generally determinable quantities: frequency of radio waves, length of the transmission path, terrain, without necessarily knowing the distribution of rainfall intensity on this terrain. The procedure is considerably simplified by graphic representation of a number of functions. Expressions are derived for probability of fading, magnitude and variance of attenuation of radio waves in rainfall, and the theoretical distribution functions are compared with experimental data. Satisfactory agreement indicates the feasibility of using the proposed method of calculation in planning ground-level communication lines for frequencies in bands beyond 10 GHz. Figures 7; tables 2; references 13: 7 Russian, 6 Western.
[18-6610]

VARIATIONS IN AVERAGE LEVEL OF UHF SIGNAL ON GOBI TRANSMISSION PATH

DAMDINSUREN, E. and TSYDYPOV, Ch. Ts.

[Abstract] The paper gives the results of research on some peculiarities of UHF wave propagation in the Gobi Desert region of Mongolia. The purpose of this work is to gather material for establishing reliable communications between populated centers in this region with very low population density. The studies were done on a transmission line between Sayn-Shand and Dzun-Bayn, a distance of 46.5 km. Signal sources on 100 and 1500 MHz were used

in the cw mode. Stability of emission power was continuously monitored, and the power at the transmitter output was periodically measured. A chart recorder kept track of instantaneous signal level. Mean hourly, daily and seasonal variations of average field level were plotted. Both meter and decimeter bands showed a higher average signal level in winter. However, the average attenuation on 1500 MHz was lower than on 100 MHz. Diurnal variations change considerably from day to day, and especially during summer, although the signal level is invariably higher during the night than in daylight hours. The range of variations in mean hourly signal levels is strongly dependent on the time of day in summer, and reaches 17 dB on 1500 MHz (01 h) and 7.5 dB on 100 MHz (04 h), and weakly dependent on time of day in winter and spring, being about 1-2.5 dB. The mean hourly distributions of the attenuation factor are approximated by a log-normal law. Summer is the worst time for UHF transmission in the Gobi from the standpoint of signal fading. Figures 6; tables 2; references: 9 Russian.
[18-6610]

HIGH-SPEED FOUR-PHASE MODEM IN SATELLITE COMMUNICATION SYSTEM WITH MULTISTATION ACCESS AND TIME-DIVISION MULTIPLEX

PEVZNER, F. A., KORYAKIN, V. S., RABINOVICH, G. V., TIKHONOV, O. S., KHAYN, G. B. and KHAR'KOV, V. I.

[Abstract] The paper discusses the particulars of design, characteristics and test results of a four-phase modem with a digital transmission speed of 51.2 megabits per second, used in standard channels of satellite communication systems with a bandwidth of 36 MHz. The unit operates in the burst mode on a carrier frequency of 70 MHz with 45 dB carrier suppression in pauses. The modem uses series 500 integrated circuits and KT-326 transistors. In addition, the modulator section includes KD512 diodes. The modulator with its amplifier is made in a single module, and the demodulator is in three modules: input amplifier with band filter, detection unit with carrier reinsertion circuit and regenerator. The modem has been tested in the cw and burst modes in the laboratory and in the satellite transmission line. As a result of findings of these tests, some parts of the modem have been optimized, in particular the carrier reinsertion system, filters of the information channel and phase modulator circuit, considerably reducing energy losses. Orthogonality error between components of the PSK signal is 1°, and energy losses are of the order of 1.5 dB in a fidelity region of 10^{-6}. Power consumption is 12.5 W. Figures 4; references 7: 4 Russian, 3 Western.

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RESULTS OF EXPERIMENTAL OPERATION OF IKM-120 APPARATUS AND OUTLOOK FOR INTRODUCTION

GRINSHTEYN, D. A.

[Abstract] The article discusses the results of experimental operation of the IKM-120 secondary digital transmission system including the SATs0 analog-digital equipment stand, the IKM-30 system as channel-forming equipment, the SVVG secondary time group formation stand, the SATs0 ChD-60 stand for analog-digital conversion of signals of the secondary group of systems with frequency separation of channels, the SLO line terminal set, an RL line regenerator unit for two-way transmission, an NRPG-8 buried container for eight systems, an NRPK-2 accessible pit container designed for two systems (and to be expanded in future for four systems), the NRPO-2 container for two systems mounted on special supports, specialized monitoring and measurement instrumentation and patrol lineman's equipment. The nominal length of a regeneration section is 5 km, and there are no more than 40 unattended repeaters between accessible stations. Limiting voltage of the remote supply at the line input is 980 V at current of 125 mA. Length of a remote supply and remote control section is 200 km. Error rate on a 600-km audio-frequency section is $2 \cdot 10^{-8}$. The IKM-120 has the following advantages over the similar K-60P system: capability for doubling the number of telephone channels transmitted on one cable pair, increased data-handling capacity, capability of direct input of discrete information, miniaturization of station equipment. The IKM-120 equipment is now being started in series production for introduction in intrazonal networks. Tables 4; references: 4 Russian.
[18-6610]

ENERGY CHARACTERISTICS OF RADIO SIGNALS IN THE CASE OF KEYING METHODS WITH MINIMUM SHIFT

DIDENKO, M. G. and KONOVALOV, G. V.

[Abstract] The problem of finding the energy characteristics of radio signals in the case of frequency-shift keying with minimum shift and offset phase-shift keying is considered. A solution is found in a general statement with the condition that the initial digital signal is a Markov sequence of binary symbols. The approach used makes it possible to evaluate the change of energy

characteristics, depending on the degree of correlation of the symbols of the initial signal, as well as to compare the corresponding characteristics with absolute and relative methods of keying. A method is proposed for calculating the energy characteristics on the basis of a relationship derived for a pulse random process (PRP) of the second order of complexity. The PRP can be used not only in the case of minimum shift and offset phase-shift keying, but also for calculation of the energy characteristics of a wide class of signals with other kinds of frequency, phase and amplitude-phase keying. Figures 4; references 8: 3 Russian, 5 Western (1 in translation). [5-6415]

OPTIMUM POWER DISTRIBUTION IN INFORMATION TRANSMITTING SYSTEMS WITH SYNCHRONIZATION CHANNEL

SMIRNOV, N. I. and ZALICHEV, N. N.

[Abstract] An information transmitting system is considered which operates in the coherent mode with several sources of informative pulse, each generating not only complex useful signal but also a separate synchronization signal, and which includes phase-type automatic frequency control in order to ensure stable performance. The receiver here consists of an input stage, a detector, a coherent-carrier discriminator and a useful-signal discriminator. The coherent-carrier discriminator has two loops, one for tracking the signal delay time and one for tracking the signal frequency. These loops can operate both from the synchronization signal, both from the useful signal, or each from a different signal. The interference immunity of the useful-signal discriminator is evaluated on the basis of power and noise relations in the system. The corresponding transcendental equation is solved semigraphically according to an algorithm which yields the optimum ratio of synchronization signal power to useful signal power. Calculations reveal that maximum interference immunity of the useful-signal discriminator is attained with the coherent-carrier discriminator operating so that the delay time tracking loop tracks the useful signal and the frequency tracking loop tracks the synchronization signal. In a real transmission system with typical parameters the synchronization signal for phase-type automatic frequency control will optimally draw about 10% of the total limited transmitter power. Figures 4; references 8: Russian. [298-2415]

MASS OPERATION SERVICES WITH TELEPHONE NETWORK ACCESS

MOREV, V. L. and MOROZ, A. L.

[Abstract] Telephone sources which can be united under the general designation of mass operation services (SLMO) are examined in the present paper. The following items are considered: 1) Classification of SLMO with access to a telephone network; 2) Seasonal nonuniformity of flow of calls at various SLMO; 3) Hourly nonuniformity of flow of calls to SLMO of various types: 4) Classification of SLMO with respect to nature of incoming calls; 5) Problems introduced with connection of SLMO into telephone network; 6) Centralized connection of SLMO into telephone network; and 7) Decentralized connection of SLMO into telephone network. First of all it is shown that connection of SLMO into the telephone network involves formation in the network of specific flows of calls directed from all the users of the network into one point of the SLMO. For passage of this load, during planning for growth of the telephone network, it is necessary to solve additional problems--in particular choice of the location and the method of connection of the SLMO into the telephone network. Solution of these in its turn depends on the special features of the flow of calls into this or that service. Figures 5; tables 1; references 11: 9 Russian, 2 Western. [6-6415]

'09' INFORMATION SERVICE EQUIPMENT FOR AVERAGE CAPACITY CITY TELEPHONE NETWORK

BEREZOVICH, L. A., IVASHEVSKIY, V. G., MOREV, V. L., MOROZ, A. L. and UZLOV, Ye. N.

[Abstract] Until recent times at city telephone networks (GTC) of average capacity the only form of equipment for information service "09" was the out of date information unit of the Pekovsk Plant for Automatic Exchanges. Then the Leningrad Branch of the Scientific-Research Institute of Communications (LONIIS) together with the Sverdlovsk branch of the Central Design Office developed a complex of equipment for the information service "09" (ASPS) intended for installation at a GTS with a capacity up to 150 thousand numbers. The ASPS equipment successfully underwent experimental operation at the Novosibirsk GTS and was placed in series production. The present report fully

describes the ASPS. The following items are discussed: 1) Special features of ASPS construction; 2) Special features of separation of operator's position for telephone workers to functional sectors; 3) Utilization of information blocks for collective use; 4) Use of electron markers; 5) Limited expectation at input of stage of distribution of ringing (SRV); 6) Block construction of equipment; 7) Computation and construction of equipment; 8) Electric Power Supply of ASPS; and 9) Complications of ASPS. Specifications, photographs and diagrams of some of the units of the ASPS are presented. Figures 5; tables 1.
[6-6415]

PHASE JITTER OF DIGITAL SIGNAL IN ASYNCHRONOUS TRANSMISSION SYSTEM

OGANYAN, L. N.

[Abstract] A digital transmission system with asynchronous joining and separating of signals and with phase-type automatic frequency control is considered, one rather important problem in the design of such a system being estimation and suppression of phase jitter. Phase jitter of the digital output signal is analyzed here, including the effect of distortions in the input signal to the phase comparator and of nonideal characteristics of the phase comparator. It is demonstrated that the phase comparator can be treated as an ideal one as long as at its input the difference between instantaneous phases of read-in and read-out pulse sequences varies in the same manner as the increments of positive and negative values of the control signal. The parameters of phase jitter of the output signal are then calculated by the method also used for determining the noise immunity of a transmission channel with single-integration delta-modulation coder, assuming the spectrum of the output signal to be discrete and the input signal to be an ergodic random process with normal distribution of its phase jitter. Also the power spectrum of the control signal is calculated, and low-frequency components are found to be generated in it by phase jitter of the digital input signal. Figures 7; references 7: 4 Russian, 3 Western.
[298-2415]

REDUCING AUDIO-FREQUENCY CHANNEL LOADING POWER IN FACSIMILE TRANSMISSION

MIKHAYLENKO, V. S. and GORACHKUN, N. A.

[Abstract] Loading of transmission systems with frequency separation of channels cannot be reduced without decreasing the power of all signals of secondary

multiplexing, including facsimile signals. Studies of loading of actual audio-frequency channels of a primary network have shown that the mean hourly power of facsimile signals may considerably exceed the conventional power assumed for calculating systems of transmission with frequency separation of channels. In this paper, methods are considered for reducing facsimile signal power with transmission of line and half-tone images as applied to "Neva" photo-facsimile equipment. It is shown that this goal can be attained by reducing the transmission signal level and switching from a negative to a positive mode of image of transmission in the case of line images, and by introducing selective predistortion in the case of half-tones. Figures 2; tables 2; references: 4 Russian.
[18-6610]

PERFECTING TECHNICAL EXPLOITATION OF CITY TELEPHONE NETWORK EQUIPMENT

VASIL'YEVA, L. S. and DMITRIYEVA, T. A.

[Abstract] The distinctive features of perfecting the technical exploitation of the equipment of various switching systems based on centralization of exploitation are considered. The principles of organization of such centralization for city telephone networks (GTS) of various structures and capacities are determined in "Basic position of centralized technical exploitation of GTS equipment" developed by the Leningrad Branch of the Scientific-Research Institute of Communication (LONIIS), together with the Leningrad GTS and the Moscow GTS. The following items are considered: 1) Centralization of technical exploitation of GTS; 2) Problem of centers for technical exploitation; 3) Perfecting of technical exploitation of ten-step automatic telephone exchange (ATS); 4) Perfecting of technical exploitation of crossbar ATS; and 5) Organization of stations with program control. References: 3 Russian.
[6-6415]

APPARATUS FOR MEASURING CHARACTERISTICS OF COMPLEX COMMUNICATION LINKS OVER
WIDE FREQUENCY RANGE

FAYEROVICH, B. M.

[Abstract] An apparatus is proposed for measuring the characteristics of
complex communication links which would include the existing 20-600 kHz
IKS-600 instrument and extend the frequency range up to 10 MHz. The apparatus
includes two identical selective level indicators, respectively, for the
influencing channel and the influenced channel of the IKS-600 instrument,
and a common frequency-conversion reference generator for both. A prototype
of this apparatus was tested in measuring hodographs of a real communication
line, first up to 600 kHz with the IKS-600 instrument alone and then up to
higher frequencies with various instruments used as level indicators. Most
suitable for frequencies up to 1.5 MHz are K-701 and MP-61 instruments (GDR),
most suitable for frequencies up to 10 MHz are W-2007 and D-2007 instruments
(FRG) connected into appropriate test circuits. Figures 6; references 3:
2 Russian, 1 Western.
[298-2415]

TRUNK REROUTING IN METROPOLITAN TELEPHONE EXCHANGE

MAREYCHEVA, N. P. and EMDIN, M. Ya.

[Abstract] Efficiency of utilizing switching equipment and trunk lines in
local telephone exchanges can be improved by dynamic traffic control. The
traffic control system that optimizes distribution in the exchange consists
of two subsystems: 1) a traffic distribution subsystem that handles alterna-
tive trunking, the order of routing selection when completing calls, rerouting
and limiting usage of alternative trunks when they are loaded; and 2) A sub-
system for trunk rerouting with consideration of trunk loading. The authors
examine the capabilities of the second subsystem as applied to existing
metropolitan exchanges with ten-step and crossbar automatic equipment. This
subsystem is based on a centralized-decentralized principle in which the
decentralized facilities are used for quality control of traffic handling with
data transmission to the dynamic network control center or technical service
center, while receiving commands from these centers that reroute trunking.
It is conclusively shown that use of such a subsystem can save a considerable
number of trunks for a predetermined quality of traffic handling. Figures 3;
references: 9 Russian.
[18-6610]

RESULTS OF TEST EXPLOITATION OF CENTRALIZED DEVICE FOR OPERATIONAL MONITORING
OF CROSSBAR-TYPE TELEPHONE EXCHANGES

GONCHAROK, M. N., GUREVICH, Ye. A., KORNEYEVA, N. M. and FIL'CHAKOVA, T. N.

[Abstract] A centralized device for operational monitoring (UOK-Ts), intended
for individual monitoring of the control devices of crossbar-type telephone
exchanges (ATSK) is described. The device was developed by the Leningrad
Branch of the Scientific-Research Institute of Communication (LENIIS). Test
exploitation (from December 1980 to December 1981) of the UOK-Ts demonstrated
its stability of operation. The potentialities were also shown of diagnosing
the quality of functioning of the controlling devices of crossbar-type tele-
phone exchanges with simultaneous simplification by several times of the work
with an automatic control of the station. The UOK-Ts device can be used
with both centralized and descentralized systems of exploitation of the
equipment of ATSK. It is concluded that the UOK-Ts is one of the technical
means making it possible to exploite the ATSK by the monitoring-correction
method. Tables 1; figures 1.
[6-6415]

SEPARATION OF MULTIFREQUENCY SIGNALS WITH USE OF S. WINOGRAD'S ALGORITHMS

TITOV, M. A.

[Abstract] A table is presented, in which for various multifrequency signals,
the amounts are compared of calculations and memory in a separation unit with
a direct realization of two versions which use S. Winograd's algorithms. From
the table it is obvious that use of these algorithms makes it possible to
reduce the number of multiplications by (15 $\div$ 70) times and additions by
(2 $\div$ 8) times. The organization of computations is considered and practical
recommendations are given with respect to it. Tables 2; references 9:
4 Russian, 5 Western (1 in translation).
[5-6415]

ANALYSIS AND SYNTHESIS OF ADAPTIVE ALGORITHM OF SPACE-TIME SIGNAL PROCESSING

POPOVSKIY, V. V., POPOV, A. S. and KONOVALOV, L. M.

[Abstract] Using the value of the vector of weight coefficients (VWC) in the form of a sum of stationary and nonstationary components, the authors synthesize adaptive algorithms for evaluation of VWC, and analyze their effectiveness. Kalman-B'yusi filters are used. The following items are examined: 1) Synthesis of algorithm of space-time processing (STP) in a stationary situation; 2) Adaptive algorithm of STP in a nonstationary situation; and 3) Analysis of precision of evaluation of trends of VWC. Figures 5; references 8: 6 Russian, 2 Western in translation. [5-6415]

ADAPTIVE SPACE-POLARIZATION MATCHED RECEPTION OF SIGNALS ARRIVING FROM DIFFERENT DIRECTIONS

RODIMOV, A. P., DAVYDENKO, V. V. and NIKITCHENKO, V. V.

[Abstract] The authors note that when two broadcast radio transmitters using a common frequency service neighboring zones, there is some intermediate region where the signals of these transmitters are comparable with respect to intensity. Interference of the signals worsens the quality of reception in a given intermediate region by antennas of vertical polarization. Analogous phenomena originate in mobile communication systems. When the interference phenomenon described, which leads to antiphase change of the amplitudes of the intensities of the electrical and magnetic fields, is taken into account, it is advisable to use a triorthogonal antenna system for reception of signals arriving from various directors in the interference region. The system consists of an electrical antenna element (AE) of vertical polarization and two magnetic AE with their axis oriented in a horizontal plane. Figures 3; references 6: 3 Russian, 3 Western (1 in translation). [5-6415]

ACCOUNTING FOR SIGNAL ATTENUATION IN HYDROMETEORS ON SATELLITE COMMUNICATION LINES

KAPLUNOV, M. B.

[Abstract] Signal fading on satellite transmission lines caused by hydrometeors (rain, snow, mist and so on) is an increasing problem as frequencies beyond 10 GHz become prevalent. In this paper the author analyzes the probability of reduction in the signal-to-noise level at the output of a satellite line below the minimum permissible reception level. The method used involves determining the mutual relation among loss increments caused by hydrometeors. It is assumed that these increments are either much greater than changes in other factors that influence signal level (such as losses in oxygen and water vapor), or that they are statistically independent of these factors (such as equipment failure). Simple formulas and graphs are given that can be used with statistical data on signal fading in satellite communication lines in order to calculate the probability of reception failure caused by weather conditions. Figures 5; references 5: 1 Russian, 4 Western. [18-6610]

FIELD INTENSITY MEASUREMENTS

SHUR, A. A., senior scientific research worker, NIIR (probably Scientific-Research Institute of Radio)

[Abstract] The author notes that at the present time the services of the State Inspection of Electrical Communications, which are concerned with the operation of radio station networks, are organizing mobile laboratories. The paper shows that with the assistance of such laboratories, it is possible to measure the field intensity of transmitting radio-television and ultra-short wave frequency-modulated stations, in order to determine the service areas of the transmitting stations, the reciprocal interference between them, and so on. The present paper describes in detail the procedures and the components of such varieties of measuring. A method of processing the measurements is presented. As a result of the calculations a median value is found of the field intensity with respect to location and time. Figures 3; tables 3. [21-6415]

INDUSTRIAL COMMUNICATION TECHNOLOGY

MATLIN, G. M.

[Abstract] The paper discusses industrial communication technology as shown at the Third International Specialized Exhibition "Communication-81" which took place in Moscow during September 1981. The author believes that problems of improvement and growth of the means of industrial and agency telephone service are found at the center of attention of developers and manufacturers of communication in many countries of the world. The advantages of the exhibit are considered and many of the items demonstrated there are described. The following are some of the equipment touched upon: 1) Program-controlled business automatic telephone station (ATS) exhibited by the Yugoslav firm Tesla (Figure 1); 2) System of internal telephone communication from Iskra, Yugoslavia (Figure 2); 3) External form of business-industrial electronic telephone station Yeravkh-100 produced by Iskra (Figure 3); 4) Control desk for these stations (Figure 4); 5) Desk for "Minimet" business-industrial telephone station from Finnish branch of the international company ITT (Figure 5); 6) Type DKh-200 electronic ATS from Finnish firm Nokia (Figure 6); 7) Exterior view of portable receivers and coding device of a system of personal radio calls (and radio communication) from the Multitone firm in Great Britain (Figures 8 and 9). The following items are discussed: 1) Devices for operational telephone communication; 2) Complex system of recording and reproduction of procedures of large conferences; 3) System of collection and transmission of data; and 4) Linear equipment. Figures 17; references: 5 Russian.
[6-6415]

MEASUREMENT OF PARAMETERS OF NETWORK CHANNELS WITHOUT DISCONTINUANCE OF DATA TRANSMISSION

POPOVA, N. E., candidate of technical sciences, chief of section of TsNIIS (Central Scientific-Research Institute of Communications) and KIL'CHITSKIY, Ye. V., senior scientific research worker; KONIIS (Kiev Branch of Central Scientific-Research Institute of Communications)

[Abstract] During an investigation of the probable connections between the parameters of audio frequency (AF) and network group channels of the long-distance primary network of the United Automated Communication Systems of the USSR (YeASS), a simultaneous evaluation was made of such parameters as instability of the overall gain, and short-lived and long time (more than 300 ms) reducttion of the signal level. The reaction is considered of a

narrow-band filter in which the average frequency is considerably longer than the band width with the reduction of the level of the input signal. Oscillographs are shown, recorded at the output of a band-pass filter with reductions of various durations and with various depths of the signal level at the input. Envelopes of the voltage of the output signal of a band-pass filter with a different depth and duration of the reduced level at the input are also shown. Table 1 of the paper presents the calculated relationships for introduction of corrections from the results of measurements of the reduced level of the signal at different depths and durations at various thresholds of fixation. A block diagram is shown of the organization of the comparative measurements of the statistical parameters with the aid of a KAI-2 complex for automatic investigations. At present development is under way on automatic measurements of the statistical parameters of the channels for audio-frequency and network-group channels, production of which is planned to begin in 1983. Figures 4; tables 2.
[21-6415]

RING BRIDGES ON MINIATURE TRANSMISSION LINES

GVOZDEV, V. I., LITVINENKO, M. Yu. and NEFEDOV, Ye. I.

[Abstract] The problem is studied of possible miniaturation of ring bridges (RB), with simultaneous simplication of their structures. Half-wave length RB are considered, fulfilled with a combination of microstrip, coplanar, symmetrical and nonsymmetrical slot transmission lines. A combination of these lines with the aid of broadband transitions makes possible a new-way high-grade approach to planning and construction of ring bridges. The formulas presented in the work for calculation of half-wave RB make it possible to construct simple and efficient algorithms for their use in a system of auto- mated planning of microwave integrated circuits. Wave vectors of scattering and the results of experimental investigations are presented. Tables 1; figures 2; references: 4 Russian.
[5-6415]

PROBLEMS IN CONSTRUCTING LOW-NOISE MULTIOCTAVE AMPLIFIERS

PANIN, N. M.

[Abstract] The present paper considers some problems in construction of low-noise multioctave amplifiers, with realization of them according to hybrid- film technology. The circuit of such an amplifier is presented and discussed. Type 2T3106A-2 transisters are used in the first two stages and in the remainder the 2T354B. The frequency band of 5-200 MHz has the following parameters: amplification factor 25 dB; noise factor 2.5 dB; output level corresponding to compression of amplification at 1 dB, 8 dB (mW); standing wave ratio of input and output, respectively, 2 and 1.3. The circuit of another similar amplifier is shown in a 1980 article by the author. Figures 2; references 5: 2 Russian, 3 Western.
[5-6415]

MICROCOMPUTER SERVING CITY TELEPHONE NETWORKS

UL'MAN, Ya. R., chief, Tallin City Telephone Network, and UL'MAN, E. E., chief, Tallin Laboratory of MONIIS (expansion unknown)

[Abstract] The authors note that on city telephone networks (CTN) of average capacity, with the number of Rayon automatic telephone stations (ATS) up to 16, it is especially effective to use microcomputers for automation of the processes of technical exploitation. This is born out by tests at the Tallin CTN where microcomputers have already been introduced or will be in the immediate future, for the solution of many problems concerned with the technical state of the network. A detailed explanation of how such problems are solved is given in connection with a description of the Tallin CTN. A preliminary evaluation of the economic effectiveness shows that introduction of a microcomputer for the solution of these problems makes it possible to obtain an annual economic effect in the amount of 1.2 rubles at one number of the network with capital expenditures at one number of not more than 1.0 rubles. Figures: 1.
[21-6415]

ELECTRICAL INSULATION

OPTIMIZATION OF NONUNIFORMITY OF RADIO ABSORBING DIELECTRIC LAYER

BUDAGYAN, I. F., MIROVITSKIY, D. I. and PONOMARENKO, V. I.

[Abstract] The possibility is considered of constructing optimum dependences of dielectric constants on the depths of a heterogenous layer. A method is proposed for realization of certain of such dependences with the aid of an artificial dielectric. The following items are examined: 1) Dependence of dielectric constant on coordinates, assuring zero reflections at one frequency; 2) Combination of transitions with smoothness; 3) Method of direct optimization; and 4) Realization of optimum dependences with the aid of artifical dielectric. The proposed method of direct optimization makes it possible to determine the dielectric constant of the separate layers of a multilayer structure, with which the reflection coefficient, averaged with respect to some set of wave lengths, is a minimum. Figures 2; references 8: 5 Russian, 3 Western.
[5-6415]

COMPARISON OF TWO NUMERICAL METHODS OF CALCULATING TWO-DIMENSIONAL PULSE MAGNETIC FIELDS WITH MOVING CONDUCTORS

BONDALETOV, V. N., doctor of technical sciences; GUSAROV, A. A., candidate of physico-mathematical sciences, and BALTAKHANOV, A. M., engineer, Department of VEI (All-Union Order of Lenin and Order of the October Revolution Electro-technical Institute imeni V. I. Lenin), Istra

[Abstract] The paper presents a finite-difference method for calculation of two-dimensional pulse magnetic fields with moving conductors and compares the method of finite difference and the method of integral equations during calcu-lation of two-dimensional pulse magnetic fields. The following items are discussed in detail: 1) Equation of electromagnetic field; 2) Solution of problem by the method of finite differences; and 3) Comparison of two methods of calculation (method of integral equations and method of finite difference) and the results of calculation. It is shown that on the basis of the method of finite differences a method has been developed for calculation of transients during acceleration of conductors in inductive-dynamics systems. Penetration of a magnetic field into the conductors is taken into account. From the point of view of the required memory and speed of calculation of a digital computer during calculation of pulse magnetic fields with a moving conductor, a compari-son with the method of integral equations shows the advantages of the new method. However, from the point of view of the speed of calculation, during computation of a system with nonmoving conductors (small size) it is advantageous to use the method of integral equations. Figures 5; references: 9 Russian. [26-6415]

PREAMP1   ?NIC DEVICE WITH INPUT CAPACITANCE COMPENSATION

[Article by V.A. Firago, B. Yu. Khanokh and O. A. Semenov, Belorussian State
University imeni V. I. Lenin].

[Text]   This article presents the results of investigating a pre-
         amplifier with input capacitance compensation designed to
         work with optical receivers.

In order to achieve high threshold sensitivity in an optoelectronic device
based on a wideband radiation receiver with high internal impedance, the pre-
amplifier must have high input impedance [1,2] and minimal input capacitance.

In order to reduce the capacitance at the preamplifier input it is best to
provide a parallel positive feedback loop [3]. The gain of such a preamplifier
will appear as follows (1):

$$\dot{K}(\omega) = \frac{\dot{K}_0 \dot{Y}_l}{\dot{Y}_l + \dot{Y}_{\text{н}} + \dot{Y}_{0.\text{с}}(1 - \dot{K}_0)} ,$$

(1)

where $\dot{K}_0 = |K_0|\, e^{i\omega t}$ – gain of amplifier without feedback (figure 1); ω –
angular frequency; t_d – delay time due to signal passing through amplifier;
Y_i, $\dot{Y}_{fb}$ and $\dot{Y}_1$ – conductances of source, feedback circuit and load of radiation
receiver ($\dot{Y} = G = jF$).

Figure 1. Equivalent circuit of optical receiver and preamplifier with par-
allel positive feedback loop.

If the conductance of the feedback circuit is capacitive, the modulo of the transfer function $K(\omega)$ appears as

$$|\dot{K}(\omega)| = \frac{|K_0| G_i}{\{[G_i + G_{\text{н}} + \omega C_{0\,\text{с}} |K_0| \sin \omega t_3]^2 + \omega^2 |C_\Sigma + C_{0\,\text{с}} (1 - |K_0| \cos \omega t_3)|^2\}^{1/2}}, \qquad (2)$$

where C_Σ is the total capacitance of the input circuit of the amplifier; C_{fb} is the capacitance in the feedback circuit.

It follows from (2) that in order to increase the sensitivity of the opto-electronic device, the capacitance of the load circuit of the receiver must be low ($G_1 << G_i$), and the capacitance C_Σ can be compensated by selecting the parameters K_0 and C_{fb} for $\omega << 1/t_d$. At high frequencies ($\omega \leqslant 1/t_d$) the compensation condition of capacitance C_Σ is violated, with the upper boundary frequency f_u reducing as conductance G_i reduces and time t_d and capacitance C_Σ increase.

The above conclusions were proved experimentally on the basis of a low-noise amplifier with frequency dependent parallel positive feedback which was developed (figure 2). The input stage of the amplifier uses a cascode circuit (transistors T1 and T2), which makes it possible to reduce the undesirable Miller effect [2]. This is followed by the primary signal gain stages (T3-T6). The positive feedback (T5, R1 and C1) compensates for the reduction in the input impedance in the amplifier at high frequencies caused by the influence of C_Σ.
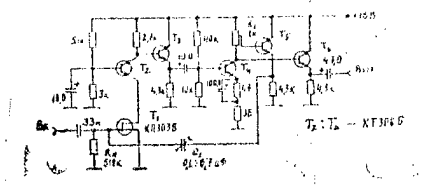

Figure 2. Schematic diagram of preamplifier.

The amplifier has the following basic parameters: intrinsic input capacitance $C_y \simeq 6$ fp; $|K_0| = 200$; $f_b = 6.5$ MHz; $t_z = 4$ nsec; in a 1.5 MHz band the noise voltage value referred to the input $U_n = 2.5$ μV (with shorted input) and $U_n = 114$ μV (for $R_1 = 510$ KΩ). The amplifier operates stably over a wide range of values of C_Σ and R_1: $C_\Sigma = (6-150)$ pf; $R_1 = (10^4 - 5\cdot10^6)$ ohms.

The modulus of the transfer function of the preamplifier is shown in figure 3 for $R_i = 510$ KΩ and two values of capacitance C_Σ in the presence of feedback (curves 1 and 2) and without feedback (curves 3 and 4).
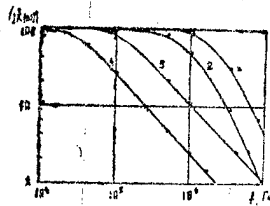
Figure 3. Modulus of transfer function of preamplifier: 1--C = 6pf; 2--C = 28 pf and 3--C = 6pf; 4--C = 28pf -- analytical curves with and without feedback, respectively; dots represent experimental values.

Compensating for the input capacitance of the preamplifier can thus provide a wide passband for the optoelectronic device with high impedance of the loading circuit of the optical receiver.

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CSO: 8144/0098

ADAPTIVE AUTOMATIC CONTROL OF ELECTROMECHANICAL SYSTEMS

BORTSOV, Yu. A., doctor of technical sciences, POLYAKHOV, N. D. and PUTOV, V. V., candidates of technical sciences, Leningrad Electrical Engineering Institute imeni V. I. Ul'yanov (Lenin)

[Abstract] The construction is considered of an adaptive control as applied to unified electromechanical systems based on standard models and stationary dynamic observations. [Two reports on the latter point by Yu. A. Bortsev and N. D. Polyakhov (see above) were published in 1977.] In addition, the results are presented of an investigation of industrial equipment which makes it possible to draw conclusions concerning the prospects for wide application of the adaptive devices developed by the authors. The structure of adaptive control and basic algorithms are considered in detail. A block diagram of a combined adaptive system is presented. Also shown are oscillograms of the frequency of rotation of an electric drive with combined adaptation, and the frequency of rotation of an electric drive with signal adaptations. Figures 3; references 14: 10 Russian, 4 Western.

MAIN TRENDS IN RESEARCH ON ECONOMY OF MATERIALS IN INDUSTRIAL AUTOMATION EQUIPMENT

POZDEYEV, A. D., doctor of technical sciences, director, All-Union Scientific Research Institute of Relay Construction (VNIIR)

[Abstract] The breakdown of materials needed for expansion of industrial relaying and other automation equipment is 60% ferrous metals, 10% nonferrous metals, 13% plastics, 17% wiring and electrical insulation materials. During

the 10th Five-Year Plan period production of low-voltage automation equipment increased by 20% with respectively 11 and 23% more economical use of ferrous metals and silver. The trend is to continue during the 11th Five-Year Plan period, research in this direction being oriented toward development of new smaller devices and systems on semiconductor and microelectronic basis, miniaturization of conventional contactor-relay devices, denser packaging of assemblies, improvement of technological processes, review of standards and specifications. With regard to protective relaying equipment this may entail modification of the operating logic, devices most critical being magnetic starters. Better economy of silver should be achieved by its replacement, at least in part, with bimetals, cermets, or alloys as contactor materials, by better adjustment to operating conditions, and by improvement of technological processes such as silver coating. Better economy of copper should be achievable by expanded use of flexible multiconductor smaller-section wire and cable assemblies wherever replacement with aluminum is not feasible. Better economy of other metals should result from improvement of stamping, coining, and coating processes as well as from replacement, where feasible, with new plastics to be developed for this purpose. Actual achievement of these goals will require an increase of production volume, or start of a new product line, and accelerated assimilation of new special-purpose and standard components into the equipment. Figures 2; tables 2; references: 1 Russian.
[30-2415]

STATISTICAL LINEARIZATION OF DISCRIMINATORY CHARACTERISTICS OF RADIO ENGINEERING SERVO SYSTEMS

DOLGIKH, M. S.

[Abstract] Phase, frequency and time discriminators, which differ by various principles of construction and consequently by various statistical discrimination characteristics, are used as comparing elements in widely-used radio engineering servo systems. In the present report graphs are presented of the coefficients of statistical linearization of the nonlinear characteristics of many such discriminators. It is shown that replacement of a nonlinear discriminator by a linear, the parameters of which depend on the statistical characteristics of the input signal, make it possible during investigations of radio engineering servo systems, which are described by nonlinear equations of arbitrary order, to employ the methods of linear analysis. Figures 2; references 5: 4 Russian, 1 Western in translation.
[5-6415]

INSTRUMENTATION & MEASUREMENTS

DETERMINATION OF CAPACITANCE COMPONENT OF OUTPUT VOLTAGE OF INDUCTOSIN

PUNGIN, L. M., SAMOYLENKO, B. F., MAKHOTIN, N. D. and BONDARUK, P. A., Khar'kov

[Abstract] The authors note than an attitude sensor of the inductosin type possesses a high potential precision with respect to measurement of angular movement. The present paper examines the capacitive coupling between the conductors of the windings of the rotar and stator of inductosins, the information concerning which is insufficient in spite of previous investigations made on inductosins both in the USSR and abroad. The existence of capacative coupling between the windings of an inductosin exerts a considerable affect on the form of the output EMF. In its turn, the error of the inductosin, operating in a phase rotation regime is proportional to the nonsinusoidal output voltage. The problem of determining the capacitance component of the output voltage as a function of the angle of rotation of the rotor with respect to the stator is solved here analytically. In order to decrease the effect on the output of the inductosin signal by the capacitive coupling between windings, fulfilled according to the circuit considered in the present paper, it is advisable to install an operating interval of the mutual arrangement of the rotor with respect to the stator in a region where the current lead-ins of the primary and secondary windings develop relative to one another at 180°. Figures 4; references 8: 5 Russian, 3 Western.
[26-6415]

INSTRUMENT IR-2.1 FOR MEASURING FREQUENCY CHANGES IN GROUP CHANNELS

MEL'NIKOVA, N. F. and GOVOROV, V. M.

[Abstract] An instrument for measuring frequency changes in pregroup as well as primary, secondary and tertiary group channels of analog transmission systems.

This IR-2.1 instrument, consisting of a transmitter and a receiver, does this through first splitting the test signal into a two-frequency one, multiplying the frequencies of each component by a different real number, then sending them through the tested channel, then sending them through the tested channel, and afterwards subtracting them so that the frequency of the output signal is proportional to the change of frequency both components have experienced in the channel. The channel does not need to be closed down for operation, but no wideband information signals must be transmitted through it during measurements. The instrument has a high degree of interference immunity and indicates frequency changes of up to 20 Hz, within 30 s on the ±10 Hz scale with an error not exceeding ±0.004 Hz and within 3 on the ±20 Hz scale with an error not exceeding 0.4 Hz. The indication is digital, with three significant figures. The instrument can also be used for controlling the frequency of a master oscillator where no frequency etalon is available. Figures 3. [298-2415]

IMPROVED DESIGN OF PHOTOELECTRIC EXPOSURE METERS

YUROVSKIY, Yu. V., Cinema Studio imeni A. P. Dovzhenko

[Abstract] A device developed by the author for mounting in an exposure meter is described. The device consists of a regulator of the light flux falling on the photoelement of an exposure meter, a special scale on this regulator, a scale on the galvanometer and the calculator of the exposure meter. A photograph is shown of the overall device and its position in the exposure meter. The author concludes that the exposure meter considered makes it possible to solve complex problems during determination of exposure and to broaden the creative potentialities for directors of photograph. Figures 3. [20-6415]

MAGNETICS

PHASE COMPARATORS AND KEYERS BASED ON NONLINEAR MAGNETIC ELEMENTS

GUZMAN, P. L.

[Abstract] The possibility is investigated of the utilization in phase comparators and minipulators of nonlinear magnetic elements, with cores variable with respect to the perimeters of the cross section. The circuit diagram is presented of such a phase comparator and its operation is explained. Included in it is a magnetic phase-comparing element which comprises a con- trolled transformer with relay characteristics, the core of which is made of a ferromagnetic substance with a rectangular hysteris loop (materials such as 65 NP, 79 NM, 34 NKMP and others). Use of nonlinear magnetic elements for construction of phase keyers, which are widely used in radio engineering, is promising. One of the possible circuits is presented and explained. Figures 3; references: 5 Russian.
[5-6415]

INCREASE OF TUNING RANGE OF COAXIAL RESONATORS WITH NONCONTACT PISTONS

ZAKHAROV, A. V.

[Abstract] The author notes that much use is made in microwave equipment of coaxial resonators retunable by noncontact pistons. Intensive development of the high-frequency part of the microwave band has lead to the necessity for operation at a higher form of oscillations ω_k, K -2,3,... In so doing the range of tuning of resonators is sharply decreased, which is characterized by the coverage factor $P_k = \omega_k max / \omega_k min$, where ω_k max, ω_k min are the maximum and minimum resonance frequencies. In addition to solving the problem of an increase of the tuning range of coaxial resonators with non-contact pistons, the present paper derives simple expressions for the coverage factor. Figures 2; references: 5 Russian.
[5-6415]

EFFECT OF SECOND HARMONIC ON MODULATION CHARACTERISTICS OF DIODE-TYPE
MICROWAVE OSCILLATOR

KARACHEV, A. A., TSARAPKIN, D. P. and YAKIMCHUK, N. V.

[Abstract] An experimental study was made of IMPATT diode and Gunn-effect diode oscillators with frequency modulation in the 3-cm wave band in order to determine dependence of their modulation sensitivity to a change in bias on parameters of the tank circuit at higher-harmonic frequencies. Each diode was mounted inside a suitable rectangular wide waveguide, the resonator cavity formed between the diode and a quasi-smooth transition to a narrow waveguide cutting of the fundamental mode. The resonator with an IMPATT diode was tuned

to higher harmonics by means of a sliding plunger in the narrow waveguide.
The resonator with a Gunn-effect diode was tuned to higher harmonics by means
of a phase shifter between diode and diaphragm. For modulation, the bias
current and the bias voltage were varied respectively. Output power at
fundamental frequency (9.76 GHz for IMPATT diode, 9.94 GHz for Gunn-effect
diode) and at second-harmonic frequency as well as shift of fundamental
frequency and change in modulation sensitivity were measured as functions of
tuner position in each case. In a separate experiment the second harmonic
had been found to be the one most strongly affecting the characteristics of
self-excited oscillations. The effect of tuning to higher-harmonic frequencies
was found to weaken with increasing fundamental frequency, becoming almost
negligible above 11 GHz in the case of an AA703B Gunn-effect diode. The
results suggest that a constant modulation sensitivity and a two-frequency
oscillator output can be attained at the same time by suppression of higher
harmonics through addition of a narrow waveguide matched to the load.
Figures 3; references: 4 Russian.
[298-2415]

GENERATION OF HIGHLY ORTHOGONAL WALSH FUNCTIONS

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[Abstract] The authors note that in connection with the development of
microelectronics use of Walsh functions (WF) are of interest in radar,
communications and during spectral analysis. The present paper discusses
processing of signals conducted with the use of the orthogonality of WF.
It is possible to decrease certain interferences and errors by the use of
the properties of the orthogonality of WF. A number of methods are considered
for generation of highly orthogonal WF with the use of preparatory functions.
Figures 4; references 3: 1 Russian, 2 Western in translation.
[5-6415]

POWER ENGINEERING

EVALUATING EFFECT OF POWER-SUPPLY ELEMENTS ON RELIABILITY OF ITS OPERATION

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[Abstract] The authors note that lately in connection with problems of the
reliability of electrical supply an intense investigation has been made of
the direction connected with the evaluation of the effect of the individual
elements on the reliability of operation of all the system with the so-called
evaluations of the "importance" of the elements. Interest in such evaluations
is caused by the fact that with their aid optimization of the reliability of
a system is substantially facilitated. The present paper is concerned with
an approximate evaluation of the "importance" and approximate methods of its
location for sufficiently complex systems of electrical supply, as well as to
show new fields of application of these evaluations and ways for further
investigations. The following items are discussed: 1) Evaluation of
"importance" of elements at the structural level of the system's task;
2) Evaluation of "importance" of elements at the probability level of the
system's tasks; and 3) Direction of farther evaluations of "importance." It
is concluded that evaluations of the "importance" of the elements is a new
effective means of investigating the reliability of electrical supply systems.
Figures 4; references 15: 13 Russian, 2 Western.
[26-6415]

SPECTRAL COMPOSITION OF INTERFERENCE FROM UNITS OF POWER SOURCES

KRIVOZUBOV, V. P., SIROTIN, L. A. and GERASIMOVA, N. I.

[Abstract] The problem is considered of interference created by various units
of the sources of secondary electric power supply (SEPS) which is one of the

most acute problems in contemporary radio electronic equipment. A mathematical model of a SEPS as a source of power is studied. It is shown that the spectrum of signals at the output of the switch of a SEPS is directly connected with the parameters of the element base which is used. Change of these parameters (e.g., the frequency properties of a transistor) leads to a change of the parameters of the model and consequently the spectrum. During an investigation of the circuits of pulse voltage stabilizers it is possible to use an expression obtained in the paper for determination of the spectral components of the voltage at the output of a power switch. At the planning stage of a SEPS the mathematical model makes it possible to determine the expected level of interference. Also requirements can be produced for the characteristics of filters which can assure a specified level of high-frequency components in the spectrum of the output voltage. Figures 3; references: 7 Russian. [6-6415]

TRANSIENT PROCESSES IN HIGH-VOLTAGE R-KVA COMPENSATOR WITH INDUCTIVE ENERGY STORING DEVICE

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[Abstract] Compensators of reactive power, rectifiers operating by forced commutation of diodes with angle regulation in the negative range up to o = -90°, are considered with either thyristors or fully controllable electron-beam diodes as switching devices. Such a compensator is protected against overvoltages by a storing capacitor connected in series with the supply through a low-power rectifier and in parallel with a discharge resistor or a high-efficiency inverter. Current and voltage transients in a single-phase compensator of this kind depend largely on the reactor inductance and the load, also on the actions of two triggers and one comparator as well as of a pulse redistributor built on OR and AND logic elements included in the compensator circuit. Current as a function of time and length of the transient period is calculated, first generally, by the method of Laplace transformation and subsequent inverse Laplace transformation, after the trigonometric-exponential current has been replaced with an approximating step function. The method is applied specifically to current and voltage transients after turn-on and turn-off of a compensator. The results of calculations are compared with oscillograms. Figures 4; references: 8 Russian. [30-2415]

NEW ACTIVITIES, MISCELLANEOUS

STABILITY REGIONS FOR LIGHTLY LOADED AERODYNAMIC BEARING

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[Abstract]   The stability problem for an aerodynamic bearing under light load is solved on the basis of the equation of state according to S. A. Sheynberg (1979), in terms of pressure distribution around the layer of gaseous lubricant and with the initial dynamic viscosity of the gas as a small parameter. Assuming an infinitely long bearing, this equation is formulated and solved as a two-dimensional one in the pressure-angle plane with the origin of coordinates on the bearing axis and on the line of maximum pressure.   An analysis of the solution reveals three zones with different stability characteristics.   In the annular inner zone, around but not including the center, stability is possible.   This zone is narrow, but can be widened through an increase of eccentricity or mean pressure.   In the middle zone stability is not possible.   In the outer zone only can vibrations excited in the inner zone run out, even vibrations excited by relatively small perturbations. The article was recommended by the Department (Kafedra) of Precision Mechanics Devices.   Figures 3; references 20: 8 Russian, 12 Western. [31-2415]

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